Carbon Cyberinfrastructure The Future of NatCarb

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Geoportal Linking Partnerships

Characterize National Potential for Broad-Scale Carbon Sequestration

Role of Distributed GIS:

- National Carbon Atlas of Carbon Sources and Potential Sinks
- Decision Support Tools for Analysis and Visualization
- Management Support Tools to Expand Data and Model Warehouses
- Support for Field Validation
- Education and Outreach



Advantages of a National Carbon Cyberinfrastructure

- De-centralization of metadata and data
 - No reason to replicate data that can be served in a web service environment
 - National layers can be provided by large data warehouses (e.g., EROS, GeographyNetwork, Census Buereu, NatCarb)
- Local control over data layers (maintain, enhance, add)
- Data requests and structures driven by XML
- Server resources are split among different computers
- Portal requests data in a multithreaded fashion
- Portal is interoperable with different databases in different formats
- Synergy among GIS/IT personnel across partnerships

NatCarb Over-Arching Goals

Connection



- Bring Society Together with Possible Solutions
- Complete Online Access to Information & Tools
 - » Expert, Decision Maker, General Public

Complexity

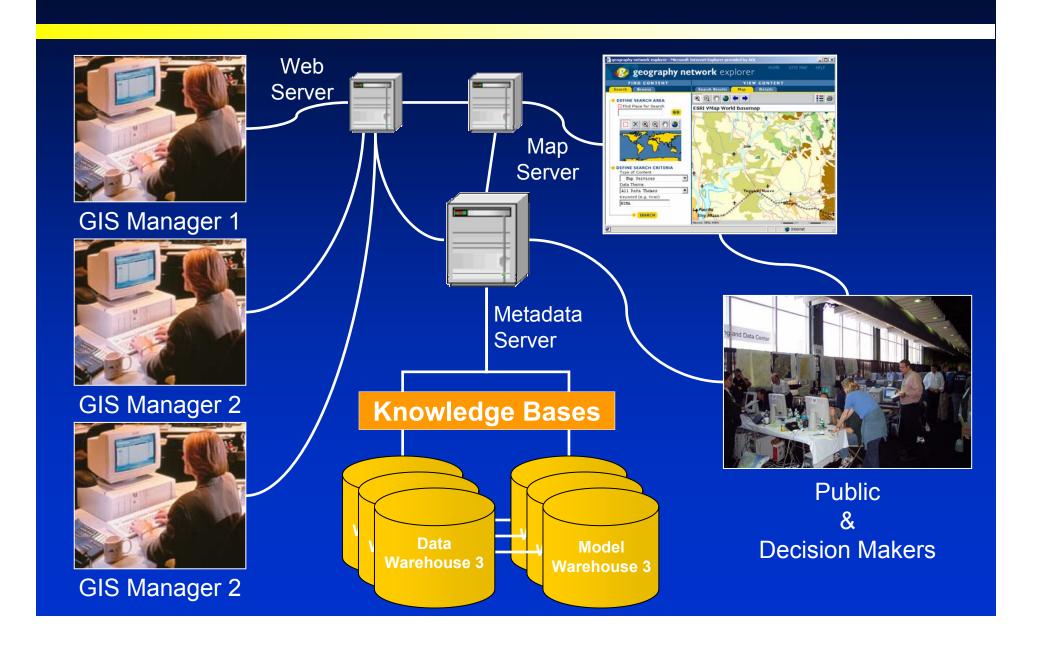
- Harder to Display
- Harder to Analyze (Integrate Data with Models)
- Harder to Manage

Coordination

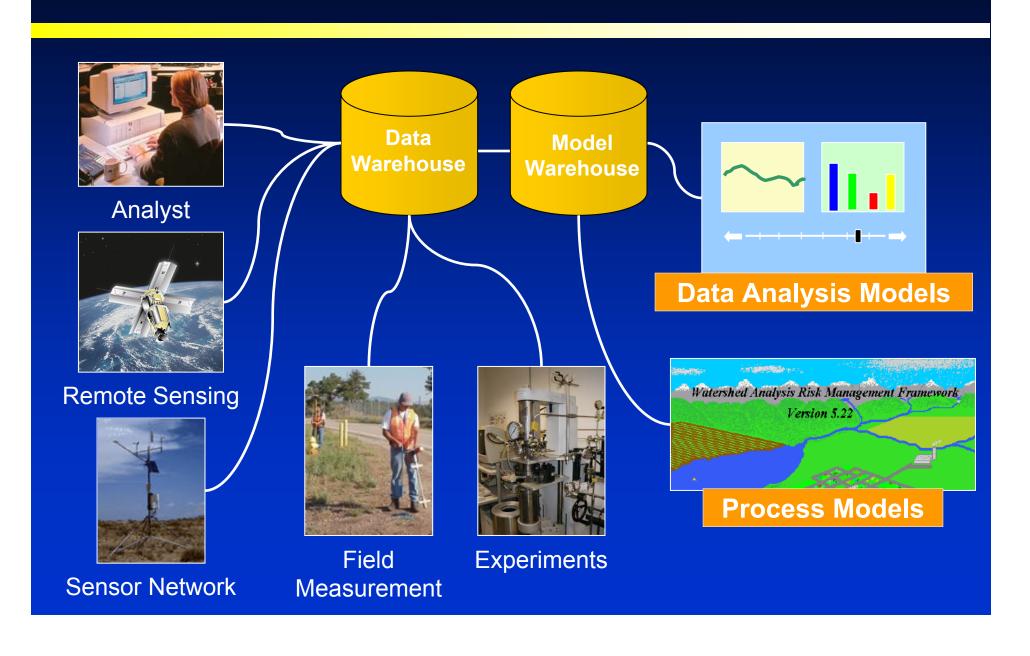
- Bring the Players Together
- Bring the Data Together

Provide Basis for Better Policies and Decisions

Distributed GIS as Glue



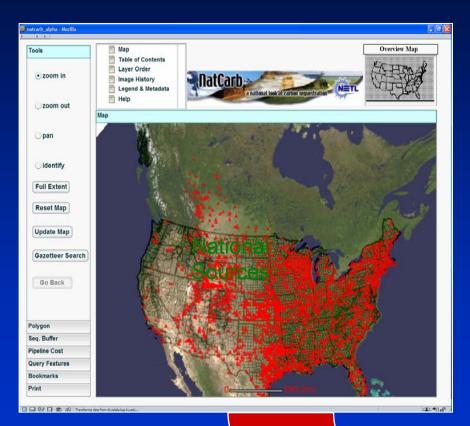
NatCarb Knowledge Base

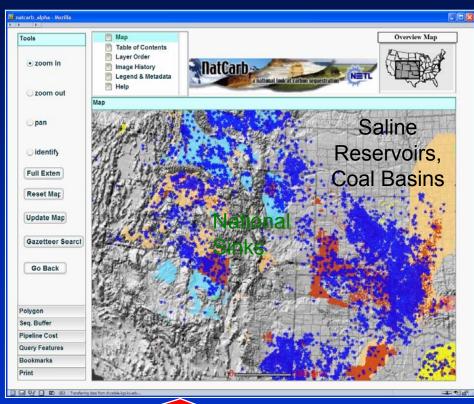


Selected Recent NatCarb Products

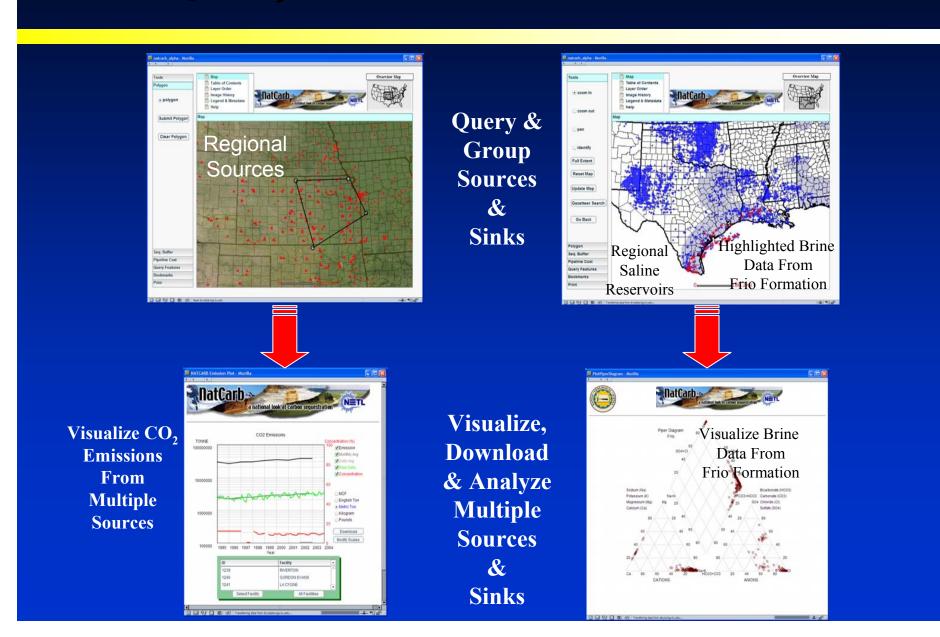
- Improved Data Access & Visualization Tools
 - Source Characterization
 - Brine Geochemistry
- Improved Data Management Tools
 - Flexible Online Data Loading
- Improved Data Analysis
 - Source to Sink Matching
 - » Pipeline Route Location and Cost Tool
 - A GIS-Based Model for CO₂ Pipeline Transport and Source-Sink Matching Optimization, Zhang et al.

Linking Sources & Sinks



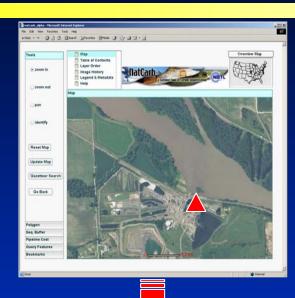


Query & Visualization Tools

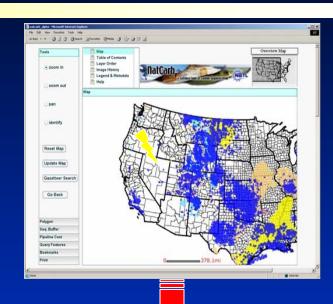


Query & Visualization Tools

High Quality Visualization of Single Source



Identify
Single
Source
or
Sink



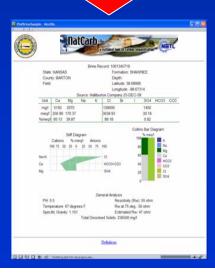
Single Sample Brine Analysis

Visualize

CO₂
Emissions
From
Single
Source

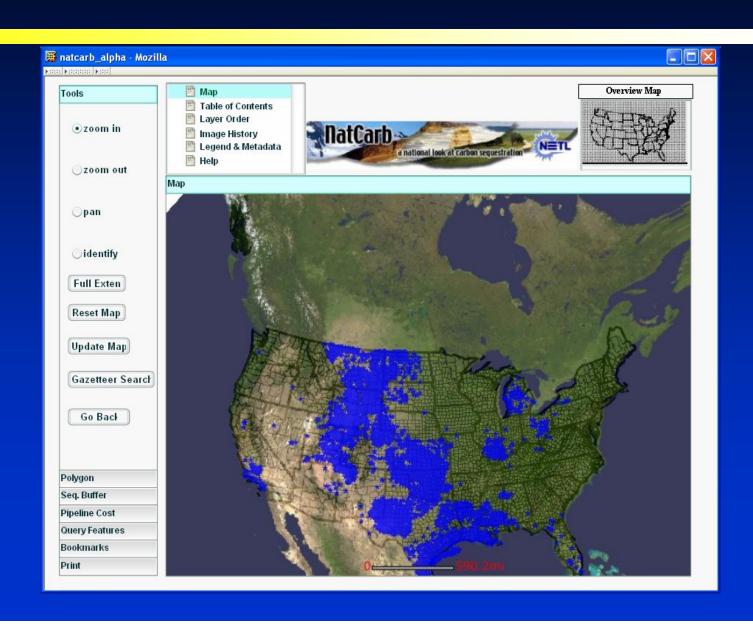


Visualize, Analyze & Download Data from Single Source or Sink

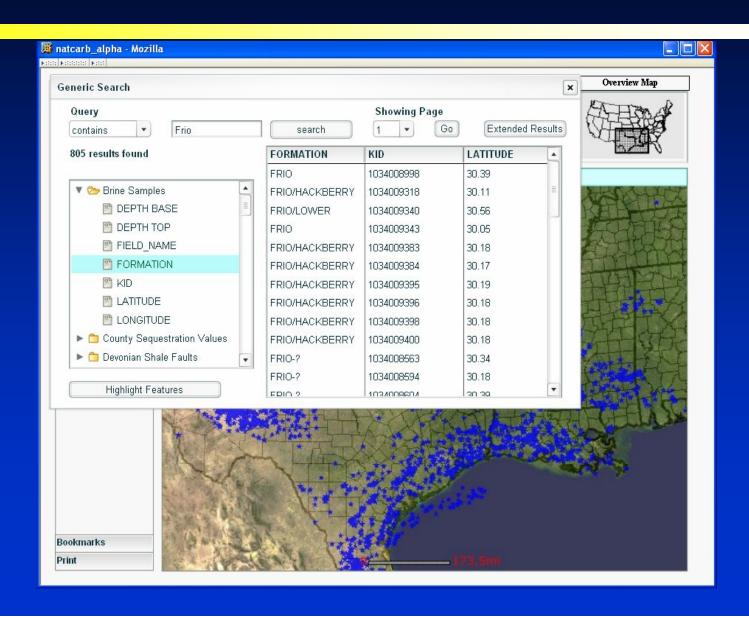


Visualize Brine Data From Single Analysis

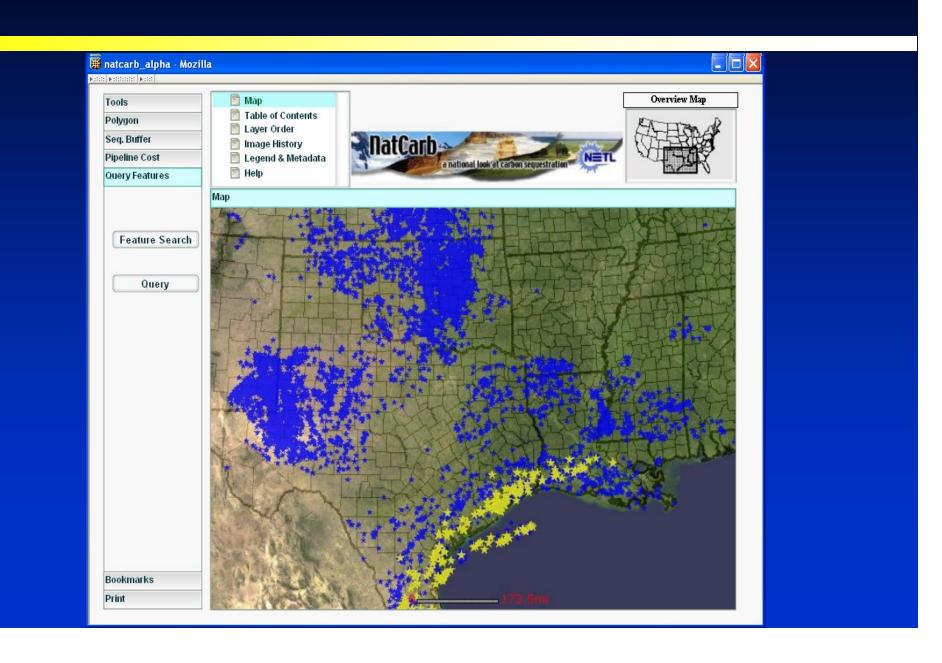
NatCarb Brine Databases

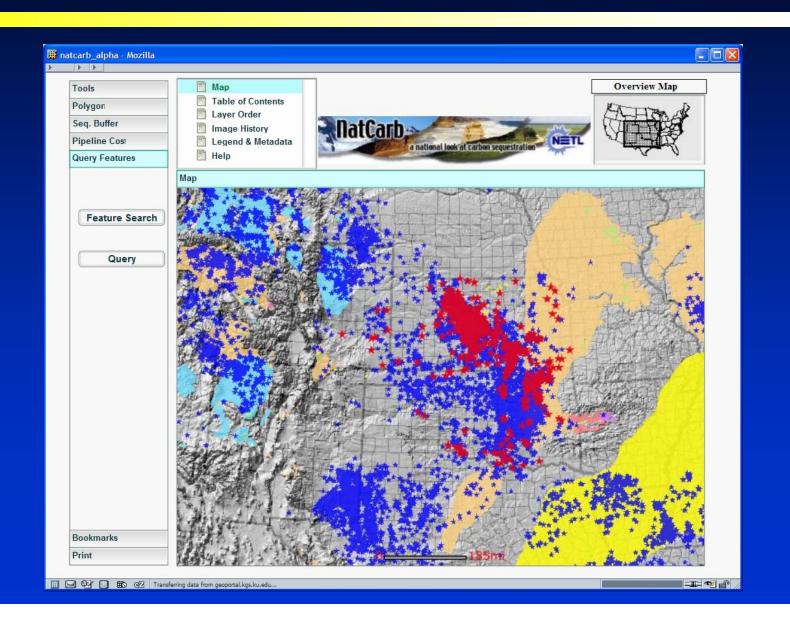


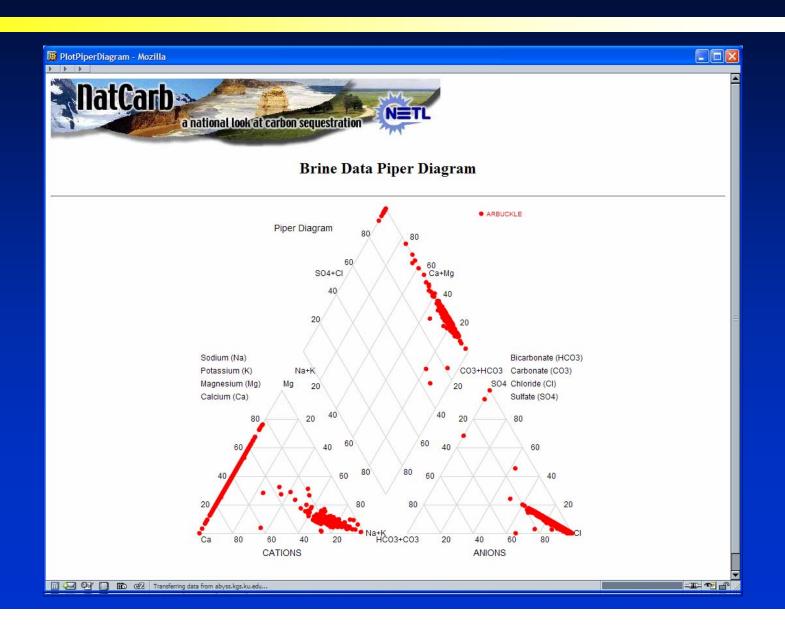
NatCarb Brine Databases

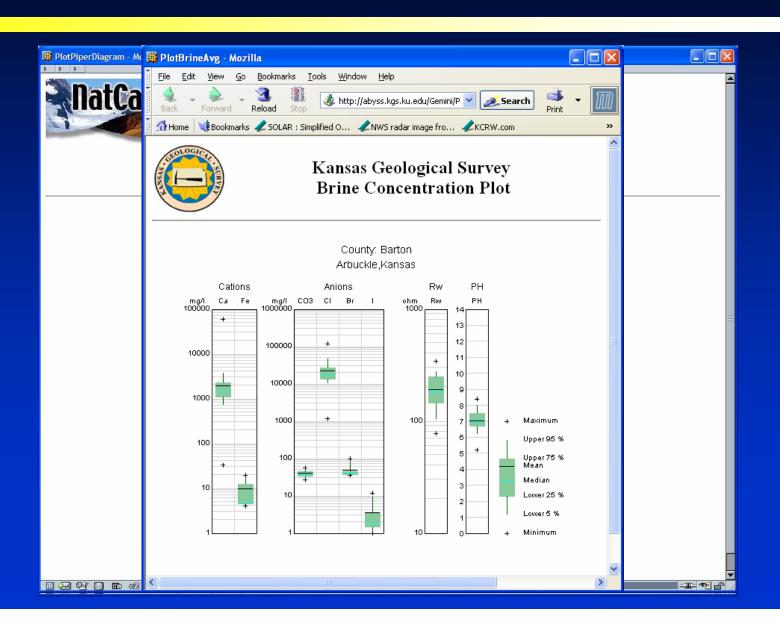


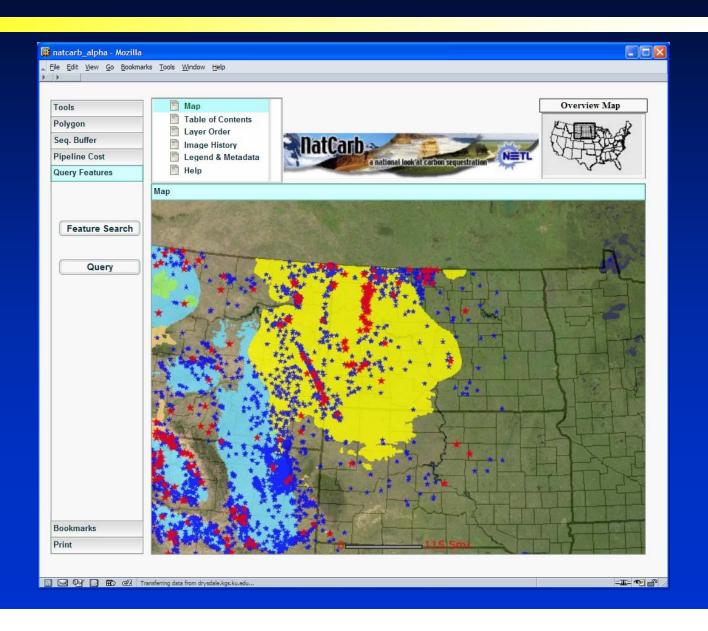
NatCarb Brine Databases

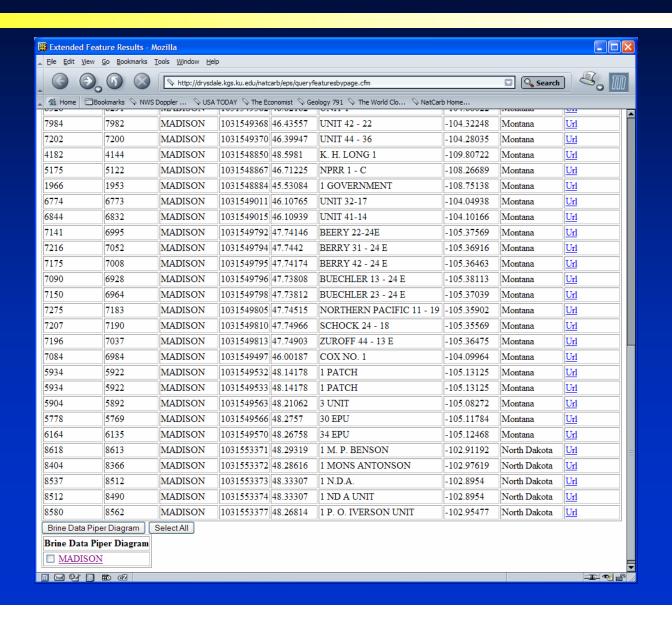


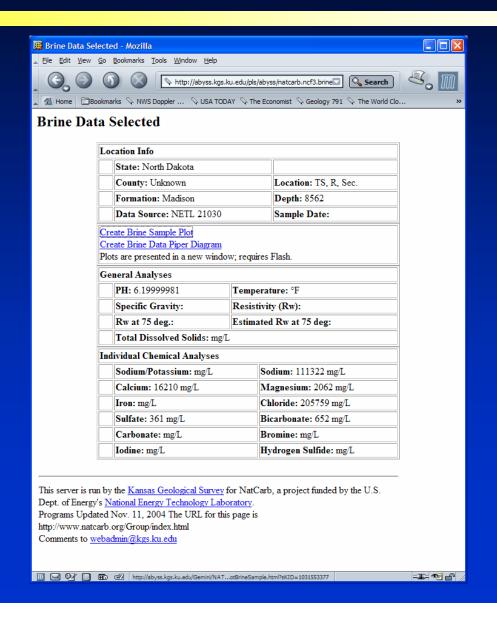


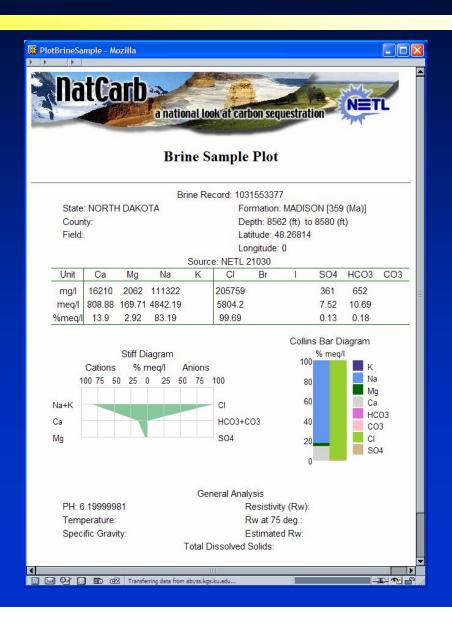


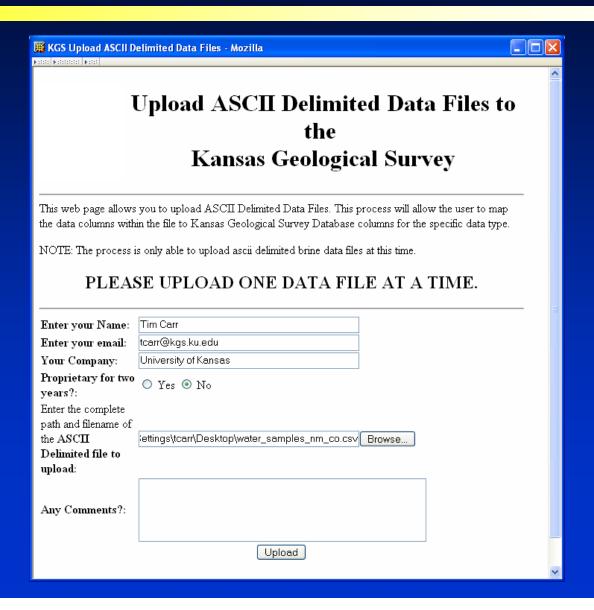


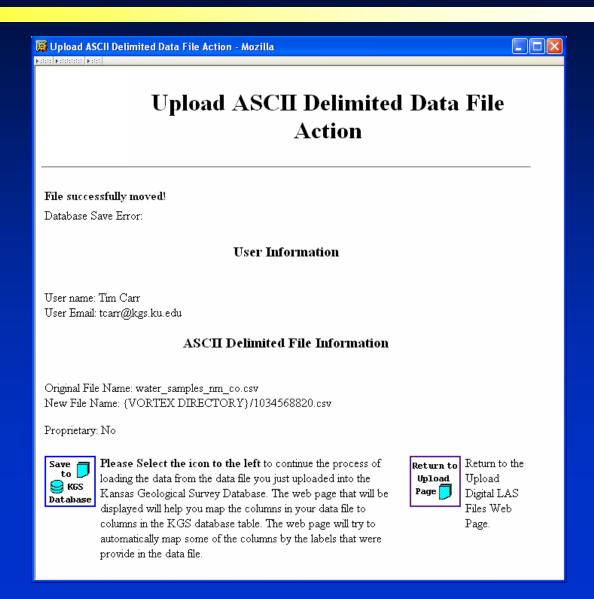










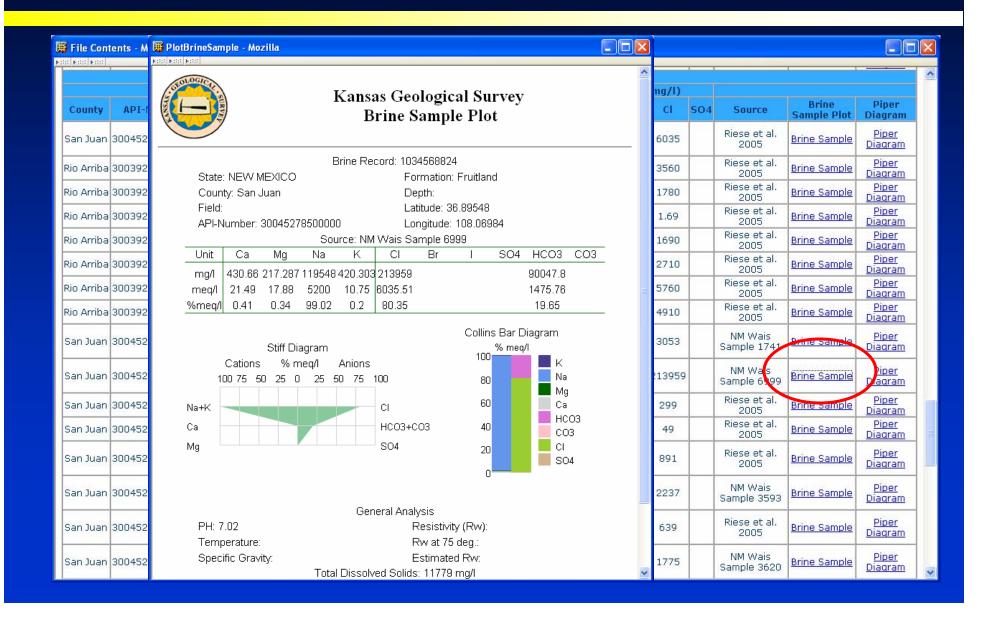








File Contents - Mozilla															X		
F33 F33 F33							NI N										
							New N Cations			0.0	ione	(mg/l)					
County	API-Number	Well Name	T-R-S	Formation	Depth	K	Na	Ca	Mg		соз	Cl	SO4	Source	Brine Sample Plot	Piper Diagram	
San Juan	30045278500000	East 103	31N 12W 14	Fruitland			5200					6035		Riese et al. 2005	Brine Sample	<u>Piper</u> <u>Diagram</u>	
Rio Arriba	30039241690000			Fruitland			4065					3560		Riese et al. 2005	Brine Sample	<u>Piper</u> <u>Diagram</u>	
Rio Arriba	30039245550000			Fruitland			1745					1780		Riese et al. 2005	Brine Sample	<u>Piper</u> <u>Diagram</u>	
Rio Arriba	30039246960000			Fruitland			11					1.69		Riese et al. 2005	Brine Sample	<u>Piper</u> <u>Diagram</u>	
Rio Arriba	30039244610000			Fruitland			2821					1690		Riese et al. 2005	Brine Sample	<u>Piper</u> <u>Diagram</u>	
Rio Arriba	30039244470000			Fruitland			2906					2710		Riese et al. 2005	Brine Sample	<u>Piper</u> <u>Diagram</u>	
Rio Arriba	30039243360000			Fruitland			5992					5760		Riese et al. 2005	Brine Sample	<u>Piper</u> <u>Diagram</u>	
Rio Arriba	30039244170000			Fruitland			4100					4910		Riese et al. 2005	Brine Sample	<u>Piper</u> <u>Diagram</u>	
San Juan	30045278500000	East 103	31N 12W 14	Fruitland			4005	267	600	8540		3053		NM Wais Sample 1741	Printe Sample	<u>Piper</u> Diagram	
San Juan	30045278500000	East 103	31N 12W 14	Fruitland		420.303	119548	217.287	430.66	90047.8		213959		NM Was Sample 6.99	Brine Sample	<u>Piper</u> Dagram	
San Juan	30045269750000			Fruitland			3290					299		Riese et al. 2005	Brine sample	<u>Piper</u> <u>Diagram</u>	
San Juan	30045275970000			Fruitland			68.57					49		Riese et al. 2005	Brine Sample	<u>Piper</u> Diagram	Ē
San Juan	30045279000000	SAN JUAN 32 9 Unit 286	32N 10W 14	Fruitland			4973					891		Riese et al. 2005	Brine Sample	<u>Piper</u> <u>Diagram</u>	
San Juan	30045279000000	SAN JUAN 32 9 Unit 286	32N 10W 14	Fruitland			2945	146	400	5917		2237		NM Wais Sample 3593	Brine Sample	<u>Piper</u> <u>Diagram</u>	
San Juan	30045284100000	SAN JUAN 32 9 Unit 274	32N 9W 28	Fruitland			4572					639		Riese et al. 2005	Brine Sample	Piper Diagram	
San Juan	30045284100000	SAN JUAN 32 9 Unit 274	32N 9W 28	Fruitland			3246	156	656	8089		1775		NM Wais Sample 3620	Brine Sample	<u>Piper</u> <u>Diagram</u>	~

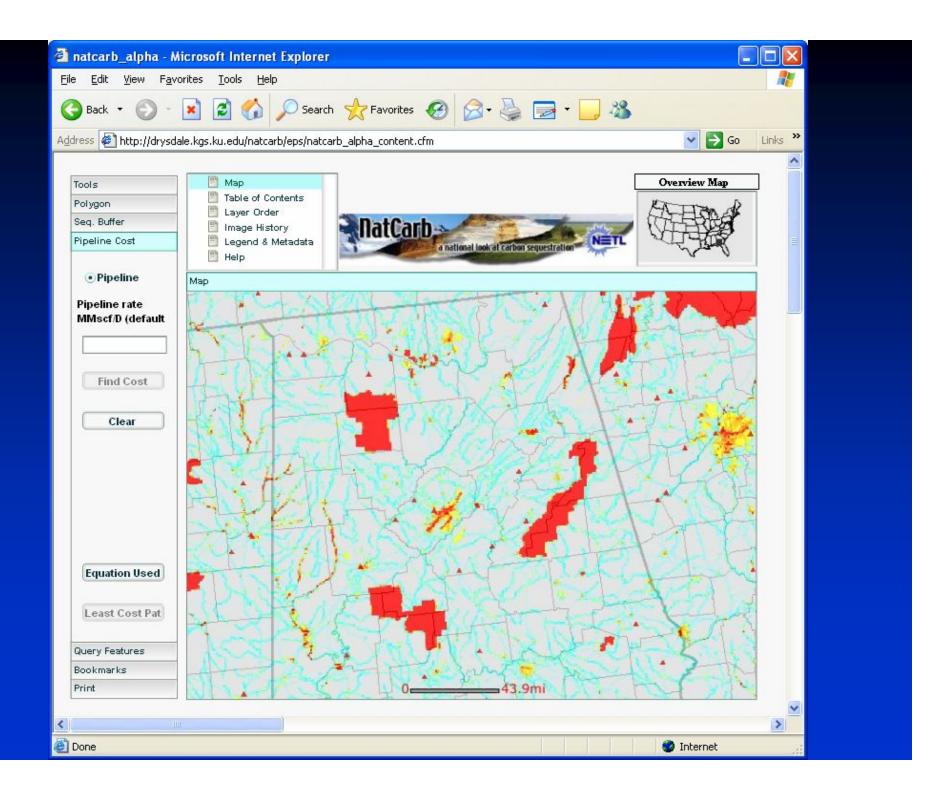


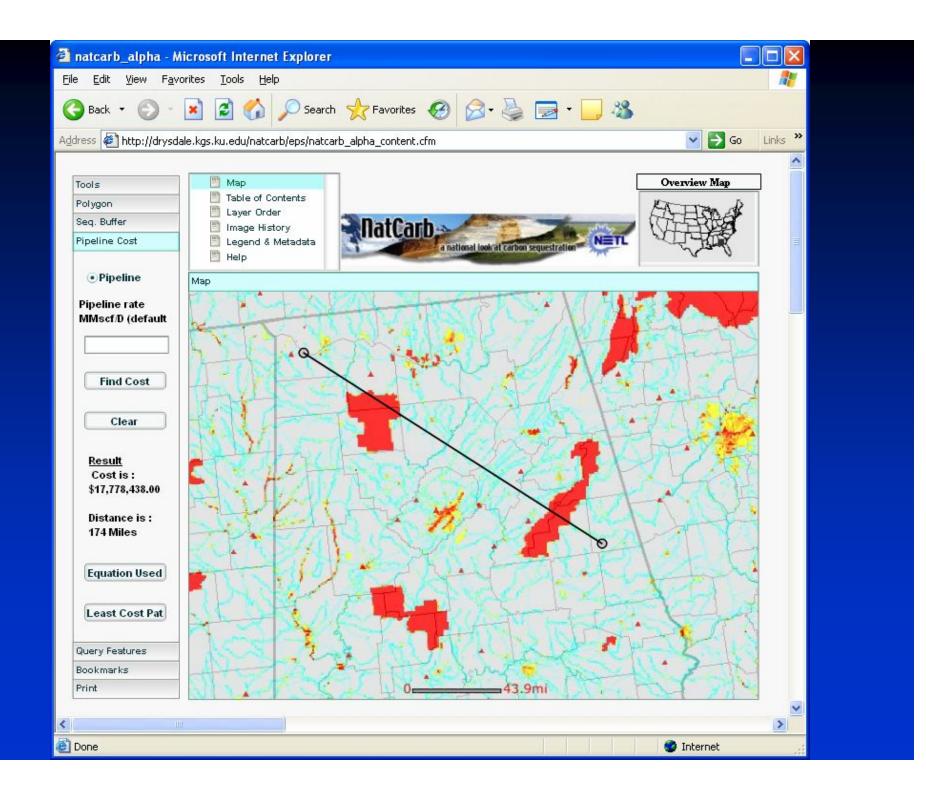
Source-to-Sink Matching

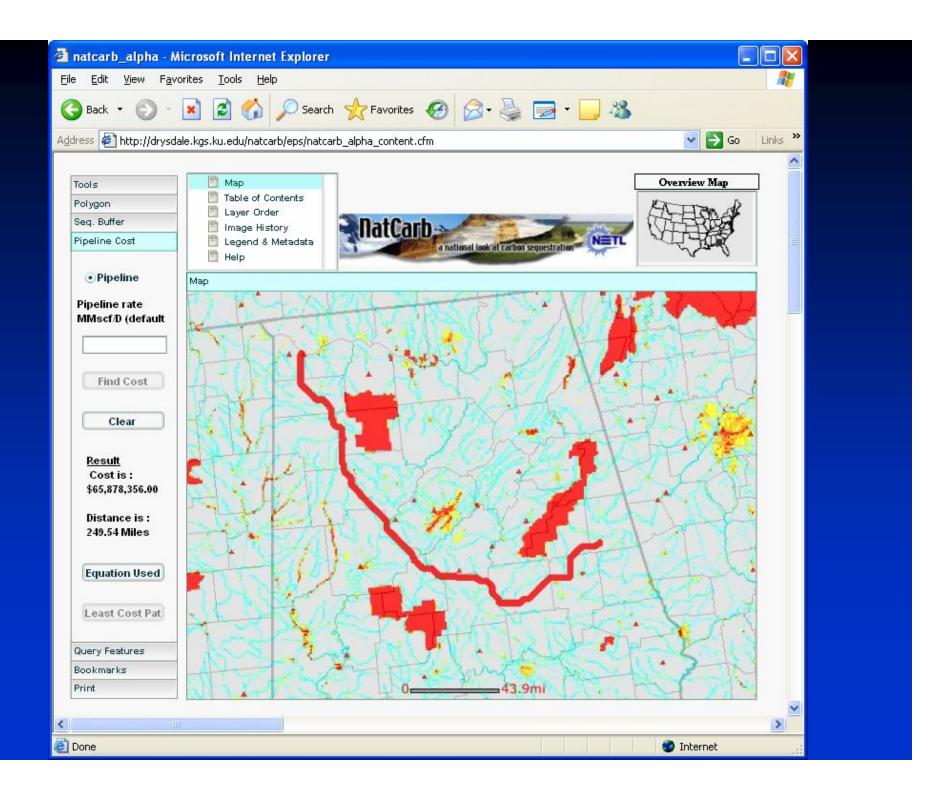
- Web-based tool implementation (NatCarb)
- One-source-to-one-sink matching route selection
- Goal: Allow the user to perform a least cost path function in real time between two distinct locations.

NatCarb Point to Point

- Technology, data, and user input required -
 - ESRI's ArcGIS Server 9.1
 - Custom built Java servlet
 - ESRI's ArcIMS map server
 - MIT cost raster dataset
 - Two points selected by the user over any area in the region within the cost raster
- Basic model -
 - Generate cost distance raster from the first point to all cells in the cost raster
 - Generate the least cost path from the data generated above and the second point







Future Short-Term NatCarb Goals

- Improved Access for General Public
 - Summary Layers NatCarb Lite
 - Simplified Navigation
- Improved Online Help
 - Tutorial
- Improved Integration
 - Workshop with Geologic and Outreach Groups
- Enhanced Distributed National Databases

National Carbon Cyberinfrastructure Summary

- A National Carbon Cyberinfrastructure is a Significant Component of National Carbon Sequestration Efforts
- Provides Improved Access to Data and Models, Better Integration, More Effective Science and Engineering, and Enhanced Decision-Making
- Distributed National Knowledge Base Permits "Loose Coupling" of Elements of Carbon Science and Decision Support
- A Carbon Cyberinfrastructure:
 - Brings Society Together with Solutions
 - Provides Model to Manage System, Display Data, Integrate Data with Models and Manage Results
- Provides a Method to Bring the Expertise and the Data Together